Title: Meta-Analysis of Event-Related Potentials in Episodic and Semantic Memory

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Introduction: An event-related potentials (ERP) study examined semantic and episodic memory effects and variability in the size and distribution of these effects across different labs. In studies using ERPs, some researchers have argued that ERP markers of semantic and episodic memory — the N400 and fN400, respectively — reflect the same neuropsychological response (Voss & Federmeier, 2011). Others have suggested that they have distinct spatial-temporal signatures and reflect different psychological processes (Bridger et al, 2012). We conducted a cross-lab experiment to address this issue and to illustrate a new approach to cross-lab analysis of ERPs.

Methods: Data were acquired from five laboratories using the same basic experiment paradigm. During an encoding phase, participants were shown a continuous series of words. After each word, they made a concrete/abstract judgment or a pleasant/unpleasant judgment. Embedded within the stimulus sequence were word pairs that were either semantically related or unrelated. Semantic N400s were computed by comparing ERPs to related versus unrelated word pairs. After a 10-minute delay, participants saw a different sequence of words and were asked to judge whether each word was "old" (previously seen) or "new" (not previously seen). Episodic fN400s were computed by comparing ERPs to old versus new words. The NEMO ontology and toolkit were used to classify and compare effects across labs.

Results: We observed robust N400s and fN400s across labs. However, there were differences in the size and scalp distribution of the N400 from 400-500ms across labs. We also observed a trend towards lab-specific differences in the magnitude and distribution of the fN400. In addition, there were differences in topography (frontal versus parietal) for the fN400 and N400 across labs.

Conclusion: The present study suggests that N400 semantic effects and fN400 memory effects have distinct neurophysiological sources. In addition, it shows how ERP labs an collaborate to address ongoing debates in the analysis and interpretation of ERP results and to conduct formal meta-analyses. While such analyses are routine in studies using functional magnetic resonance imaging (fMRI), they are practically nonexistent in ERP research. The ability to conduct ERP meta-analysis will accelerate new discoveries in cognitive neuroscience.